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Measuring the Globalization Degree of Trade from 2003-2013: Is Globalization of Economy Coming to an End?

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Measuring the Globalization Degree of Trade from 2003-2013: Is Globalization of Economy Coming to an End? [1]

Bruno G. Rüttimann

Abstract

This paper measures the globalization degree of physical trade flows based on WTO figures from 2003-2013. The paper is an annual up-date of former presented papers representing a long-term study analyzing the evolution of the globalization phenomenon. The entropy-based metrics used to compute the interweavement of trade flows is based on a Boltzman derived concept of entropy, i.e. the higher the order (high inequality) the lower the entropy, leading to a new defined statistical entropy. Translated to economy: the higher the inequality (high concentration of flows) the lower the entropy, i.e. the lower the globalization degree resulting in a higher risk of the economic system. The paper shows that economic world trade, as a whole, has been globalizing during recent years but with different patterns: de-globalizing for advanced economic regions, such as North America and Europe, and globalizing for emerging economic regions. Furthermore, it shows that globalization or de-globalization, intended as interweavement of flows, is not a result of the absolute trade volume but of the growth rate of trade volume. The Globalization Types Model with globalization type 1a of commodities, globalization type 1b of specialties, and opportunistic low-cost globalization type 1c, gives an explanation for the different regional evolutions. At the beginning of economic development, globalization is governed by the H-O resource endowments trade logic complying with complementary needs of economic regions, spreading trade flows to new destinations, whereas advanced economies are concentrating on preferential destinations, following Linder's trade model based on similar consumption patterns. The aggregated result seems to confirm inverse Kuznets evolution of globalization, explainable with the Central Theorem of Globalization and the Maximizing-Value-Net-of-Risk globalization logic.

Keywords: Economic globalization, inequality, risk metric, statistical entropy measure, trade flows, Heckscher-Ohlin, Linder, Kuznets, Globalization Types Model, Central Theorem of Globalization, Trade Globalization Postulates.

Acknowledgments: Our thanks goes to Christophe Degain, Senior Statistician at WTO, for providing me with the latest trade data and interesting inputs.

N.B.: This paper is presently the latest version available for this long-term research on economic globalization comprising the most recent update of insights gained leading to a new normative globalization theory.

[1] This paper has been presented at ATINER's 13th Annual International Conference on Finance, 25-28 May 2015, Athens, Greece.

Introduction

World trade is increasing; but is also globalization, i.e. the interweavement of trade flows increasing? Globalization is a natural phenomenon of an open economic system. Liberalization and deregulation of trade barriers as well as bilateral economic development agreement have been leading to an increase in trade and therefore in wealth generation but bears also the danger of exploitation of disadvantaged regions. The emerging economies, namely the BRICS countries (Brazil, Russia, India, China, South Africa) are, or will be, the major drivers and stakeholders in the future importance of economic development. But also within the emerging economies substantial differences within action scope or preferential trade partners are observable. The development of economic globalization is a mix of increase in physical trade, sustained foreign direct investments, financial market repercussions, and an increase in human mobility, all supported by telecommunication and increase in transparency of efficient market places via the world wide web.

Different types of indicators have been developed to measure the multiple dimensions of globalization. For a non-exhaustive comparison (Caselli 2006, Dreher 2010, Ghemawat and Altam 2013, Fagiolo 2012). The evolution of world economic development is monitored by the WTO (World Trade Organisation) as well as e.g. the yearly published KOF ETH Zurich globalization indicator (Swiss Economic Institute of Swiss Federal Institute of Technology). KOF uses a multidimensional index to capture economic, social, and political dimension of globalization (Dreher ?????). All these type of indicators have a rather descriptive character measuring merely the evolution of globalization. Other research is rather focused on measuring the intrinsic nature of globalization, i.e. how globalization originates and its effects. Such research aiming to understand trade patterns, evolution of value-chains, destination of investments, behavior of networks, as well as AB models are described (Gallegati et al. 2008, Battiston et al. 2006, Gabrielli 2012, Karunaratne 2012, Pietronero et al. 2013, Stiglitz 2004). It is not intended here to perform a comparative analysis of existing research work but to update an ongoing study presented first in 2009 at the occasion of a globalization congress at University of Ostrava and published by the University of Stettin in Europa Regionum (Rüttimann 2010a), and institutionalized finally from 2011 onwards (Rüttimann 2011a), based on the theory developed in (Rüttimann 2007). The hereafter used indicator is a specific developed globalization indicator having normative character, i.e. bearing the intrinsic globalization law (Rüttimann 2011a, 2007).

The present paper is a yearly updated study of previous papers (Rüttimann 2011a, 2012, 2013, 2014). It will concentrate the analysis first on the evolution of physical trade flows within the major world economic areas given by the WTO table i04, namely North America NA, South Central America SCA, Europe EU, Commonwealth of Independent States CIS, Africa, Middle East ME, and Asia. We will apply a new inequality indicator based on statistical entropy which incorporates also the intrinsic reason of minimizing risk by even distribution of portfolio, formalizing a built-in rational explanation of

globalization (Rüttimann 2011a, 2007). Within the main economic globalization types, namely type 1 (physical flow globalization), type 2 (financial and capital globalization), type 3 (human factor globalization, i.e. migration and services), each is characterized by subtypes (Rüttimann 2007, 2009, 2011b) of this comprehensive globalization model. We will use the type 1 globalization to explain the different evolution of globalization in each geographical region.

Second we will apply the Central Theorem of Globalization (CTG) and its corollary (Rüttimann 2011a, 2007) to understand the underlying logic of evolution of trade. The paper will investigate questions such as: How are different globalization patterns linked to the trade flows? Why should different regions perform differently? Is it a consequence of different resource endowment or the maturity of the economy? Which are the possible economic driving causes for the different trade patterns? And finally, is globalization of economy coming to an end?

Theoretical Background

In the following, we will apply the globalization measure according to (Rüttimann 2011a, 2007) to foreign trade flows. From the paradigmatic interpretation of thermodynamic entropy we can define risk as a dualistic view of order in an economic system, therefore the more order (i.e. inequality) that exists in an economic system the more risky the economic system (or vice versa, the more equality a system shows the less risk it presents). The greater the inequality compared to the riskless state with equality $\psi_{XY}=1$, the larger the risk of an atomic element. Whereas in the here presented context inequality refers rather to a single element of a system, the concept of risk can be aggregated to the entire system.

Risk as a Measure for Globalization

According to the Pigou-Dalton Transfer Principle and the interpretation of entropy law, we will apply the Minimum Risk Principle (Rüttimann 2011a, 2007) to analyze the foreign trade, i.e. the material globalization type 1 (Rüttimann 2007, 2009, 2011b) dealing with physical flows of a product α, by applying it to which country X exports to which countries Y, and which country imports from which countries represented by the trade matrix $T^{\alpha}=[t^{\alpha}_{XY}]$. For a trade system we can build the market share vector of an economy and calculate the inequality measure ψ_{XY} as the market share of X in Y compared to the overall market share of X. For economy X we can calculate the risk $r_X(\psi_{XY})$ of its portfolio of activities in the countries Y. The lower the inequalities in each country Y the lower the risk value and therefore the higher the globalization degree of the country X. If the inequality is $\psi_{XY}=1$ for all Y then country X has the same market share in all countries Y and its portfolio of trade-flows is proportional to the market composition according to its competitiveness. We can consider the CTG and its corollary as the basics to

explain that our economy will globalize naturally with the existing deregulation tendency. This risk metric is a genotypic measure, bearing the intrinsic law of economic globalization.

Globalization Logic: Maximizing Value Net of Risk (MVNR)

But entropy is not the sole governing physical law of thermodynamics. Indeed, if a transformation happens is determined by free enthalpy. The same is also applicable to economics (Rüttimann 2007). By adding the concept of thermodynamic enthalpy to the economic system, we can also explain the presence of an eventual de-globalization trend (i.e. an increased order of the economic system corresponding to an increased inherent economic risk of the system). This matches the fundamental economic law that a higher risk corresponds generally to a higher return.

Minimizing risk is only one cardinal law (this law models the globalization extension), maximizing profit is the other cardinal one (this law models the final rational acting). Globalization is extending the business scope to new geographic areas, and the aim is:

- to increase the profit generation (explicit strategy of profit maximization), and at the same time
- it reduces the risk of the portfolio (implicit law of risk minimization).

The final governing principle of economic globalization is therefore risk deducted value maximization (Rüttimann 2011a, 2007), i.e. MVNR (Maximizing Value Net of Risk). With this principle we can explain the rational of any economic actor not only limited to perfect competition models but including oligopolistic markets comprising MNE (Multi National Enterprises) and extended to world trade why globalization happens.

Methodological Approach

To measure the globalization degree of a set of geographical regions, which have been defind at the beginning, regarding the economic dimension of trade, as well as the evolution of globalization, we will use the inequality risk metric (Rüttimann 2011a, 2007) applied to yearly physical trade flow, statistics published yearly by WTO. Despite physical trade flows, today, are not reflecting any more perfectly the performance of an economic region (Maurer and Degain 2010), we will continue to use these data due to availability reasons of long term time series. We will not enter here into a detailed explanation of the applied metric for which we refer to (Rüttimann 2011a, 2007), giving only a brief introduction. In brief: this new metric represents a paradigmatic approach of Boltzmann entropy of a thermodynamic system leading to statistical entropy. Instead of talking about entropy in economics, in the following we prefer to talk about risk of an economic system, which is more

appropriate, i.e. the higher the entropy, the lower the risk of the economic system, i.e. the higher the globalization degree.

Let us define the trade matrix $T^{\alpha}=[t^{\alpha}_{XY}]$ showing the trade flows from economic region X to economic region Y for a product α or, in this case, for the whole trade volume. We can now build the market share array of an economic region and calculate the inequality measure $\psi_{XY}=p_{XY}/p_X$ as the market share of X in Y compared to the overall market share of X obtaining the inequality matrix for the whole economic system $\psi^{\alpha}=[\psi^{\alpha}_{XY}]_{\infty}$. For economy X we can calculate the risk $r_X(\psi_{XY})$ of its portfolio of activities in the countries Y as the 2nd momentum of the elements belonging to the inequality array ψ_X relative to the attractor 1

$$r_X(\psi^{\alpha}_{XY}) = \frac{\sum_{y=A}^{Z}(\psi_{Xy}-1)^2}{card(Z)} \qquad (1)$$

The lower the inequalities in each country Y of supplying country X, i.e. the more even is the repartition of trade portfolio and therefore the interweavement with other economies, the lower the aggregated risk value and therefore the higher the globalization degree of the country X; this concept leads to the CTG and its corollary (Rüttimann 2011a, 2012, 2007), which we will apply. If the inequality is $\psi_{XY}=1$ for all Y then country X has the same market share in all countries Y and its portfolio of trade-flows is proportional to the market composition and marginal matrix distribution according to its competitiveness and the inequality risk $r_X(\psi_{XY})$ will become 0, i.e. attain maximum globalization. The array $r_X(\psi_{XY})$, containing the single risk of each economy, can be aggregated to the risk of the entire system of economies $r(\psi_{XY})$ representing the world globalization degree in terms of interweavement. Inequality measure can be applied to supply or demand; we will analyse in the following for the pattern analysis rather the supply-side, i.e. the exports marginal distribution of the trade matrix. The aggregated world risk value, of course, is the same for both marginal distributions. We will interpret empirically the resulting patterns based on theoretical considerations.

The upper part of Table 1 in the annex shows the world trade flow matrix of the year 2013 (source WTO Table i04), as well as in the middle part, derived trade shares measures of the geographic regions, and in the lower part relative inequalities calculated according to (Rüttimann 2011a, 2007). The single inequalities are then aggregated to a risk measure of each economic region according to the two dimensions of supply portfolio (exports) and demand structure (imports); the matrix contains also geographic intra-trade t_{XX}. These individual "geographic" risk figures $r_X(\psi_{XY})$ for exports, and $r_Y(\psi_{XY})$ for imports, are finally aggregated to the world risk index $r(\psi_{XY})$ measuring the economic globalization degree, i.e. the extension of the world economic trade system.

With this paper we want to confirm or reject the findings of previous publications (Rüttimann 2013, 2014), findings which we will call Trade Globalization Postulates.

Enunciating the Trade Globalization Postulates

The results of previous research published in (Rüttimann 2013, 2014) can be summarized with the following empiric conclusions about trade globalization, globalization seen as interweavement of trade flows, giving increased insights into this phenomenon. We can enunciate them as the following Trade Globalization Postulates.

- Postulate 1: At the first stage of globalization, economic globalization at aggregate level of all economies is correlated to trade volume (L-curve): increased trade will reduce risk level (i.e. indicating increased globalization).
- Postulate 2: The economic world as a whole is globalizing but with different evolution for the different economic regions: globalizing for the emerging economies, de-globalizing for the mature economies.
- Postulate 3: This means that for each economic region, as the maturity degree of an economic region evolves, we can see the transformation from an L-shaped curve to an U-shaped curve for the risk level, i.e. inverse Kuznets pattern.
- Postulate 4: Further, graphical correlation shows that on a long-term basis not the trade volume but the growth rate determines the evolution of globalization: i.e. the structural segregation of long-term de-globalizing advanced economies from globalizing emerging economies is not given by absolute trade volume but correlated to reduced trade growth, i.e. de-globalization is accompanied by reduced growth rate of production (for the time being, no causalization has been proved).
- Postulate 5: Emerging economies, mainly focused on commodities following type 1a globalization logic, are more sensitive to volatility and therefore to temporal (short-term or economic cycle) de-globalization as they respond to economic cycle contraction than advanced economies, advanced economies which maintain their risk level, i.e. their globalization degree.
- Postulate 6: A strong globalization tendency is initially seen by economies following commodity type 1a globalization and subsequently low-cost opportunistic type 1c globalization following Heckscher-Ohlin factors endowment theory. Specialty type 1b globalization, observable more in advanced economies, favors de-globalization, due to preferential destinations according to Linder's similar demand pattern theory.
- Postulate 7: The evolution of globalization (measured as interweavement) given by the CTG can be explained by the universal

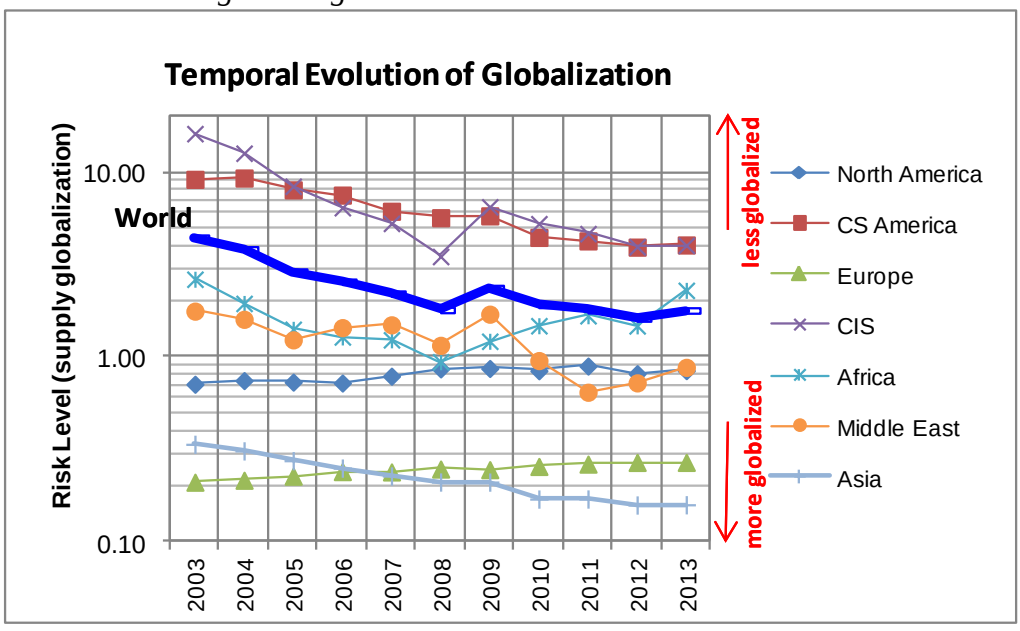
ultimate economic rational Maximizing-Value-Net-of-Risk logic, corresponding to the efficient frontier of a portfolio of activities, which allows to explain also a de-globalization evolution.

These seven postulates give an increased understanding of the trade globalization phenomenon. The evolution has to be monitored during the next years to verify these findings.

Analyzing Trade Pattern Between 2003-2013

The world trade flows on an aggregated level have increased according to WTO source from 7,290 b$ in 2003 to 17,899 b$ in 2013 showing a stagnation during the last two years after the unrelenting growth of the world economy with a deep throwback to 11,978 b$ during the world financial crisis in 2009, as shown in the data in the upper part of Table 2 in the annex. The associated geographical areas and world risks, calculated according to Equation (1), are shown in the lower part of the same Table 2 in the annex; it emerges that economic world risk metric diminished from 4.43 in 2003 to 1.62 in 2012 demonstrating increased interweavement of economies, hence a more globalised world of trade flows but increasing again to 1.79 in 2013. The graphical evolution of regional risks is presented also in Figure 1 and reveals a heterogeneous evolution, according to postulate 2.

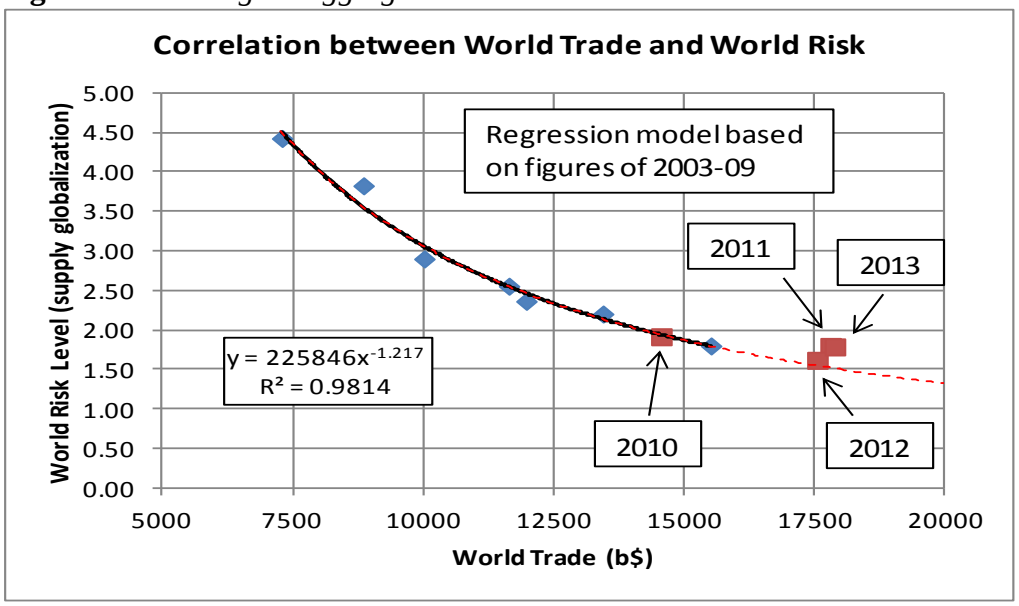
Figure 1. *Regional Risk of Different Macro-Economic Regions according to Table 2 Revealing Heterogeneous Evolution*



Building the correlation between world trade and world supply risk we obtain the regression model shown in Figure 2. The applied model is the model

calculated using figures from 2003-2009 presented in (Rüttimann 2012) but with the figures from 2010, 2011, 2012, and 2013 added to test the model. The present results including the four recent years confirm the validity of the regression model and already emerged results from the 2003-2009 analysis (Rüttimann 2012), confirming on a regression base postulate 1. It shows, that the risk level diminishes, i.e. the interweavement of globalization increases with the growth of trade volume. On the contrary, the risk increases with shrinking trade volume; that means, that during an economic downswing exports are concentrated on specific preferential areas less affected by the downswing, increasing portfolio inequality and therefore increasing risk level. Nevertheless we observe that for the trade volume of 2013, as already in 2011, the model overestimate the globalization level, revealing in reality a higher risk than the model. Although this fact is evident, it is too early to transpose postulate 3 on aggregate level.

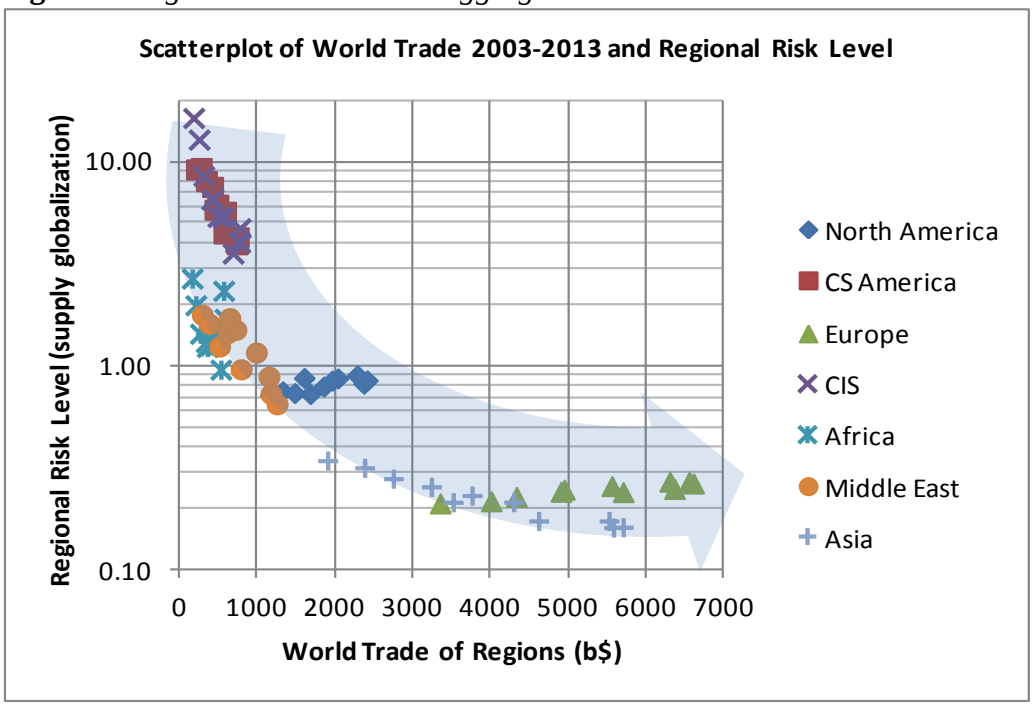
Figure 2. *Modeling on Aggregate Level*



If we look at disaggregated data, i.e. at the evolution of regional risk shown in the lower part of Table 2 or Figure 1, we notice that Asia and SCA have shown a continuous reduction in risk, also during 2009, i.e. a clear globalization trend, whereas NA, and especially EU, have shown a continuous de-globalization trend during the period 2003-2013 (Figure 1) but NA with a significant throwback in 2012. The regions CIS and ME show also a globalization tendency but suffered a throwback in 2009 due to the world economic crisis, which aligns with postulate 5. This might be given by their heavy commodity orientation: commodities being very sensitive to economic cycles, standing at the top of the value chain. Also Africa showed the same throwback as CIS and ME but after 2009 has continued to increase its risk level; this is an indication that the trade flows were redirected and concentrated. Indeed, shipments from Africa to Europe and North America have decreased

over-proportionally (this data has not been annexed to the paper) whereas the shipments to Asia have been maintained. After increasing trade in 2012, Africa did not increase further trade in 2013 but increased the risk level. On a long term basis (2003-2013) we believe to see the U-shaped form of postulate 3 for the African risk evolution, but this volatility might be influenced from the relative reduced quantity of trade (approximate 600b$). If the reduced supplies to NA and EU are more due to reluctant economy than to priority shipments to Asia has not been investigated.

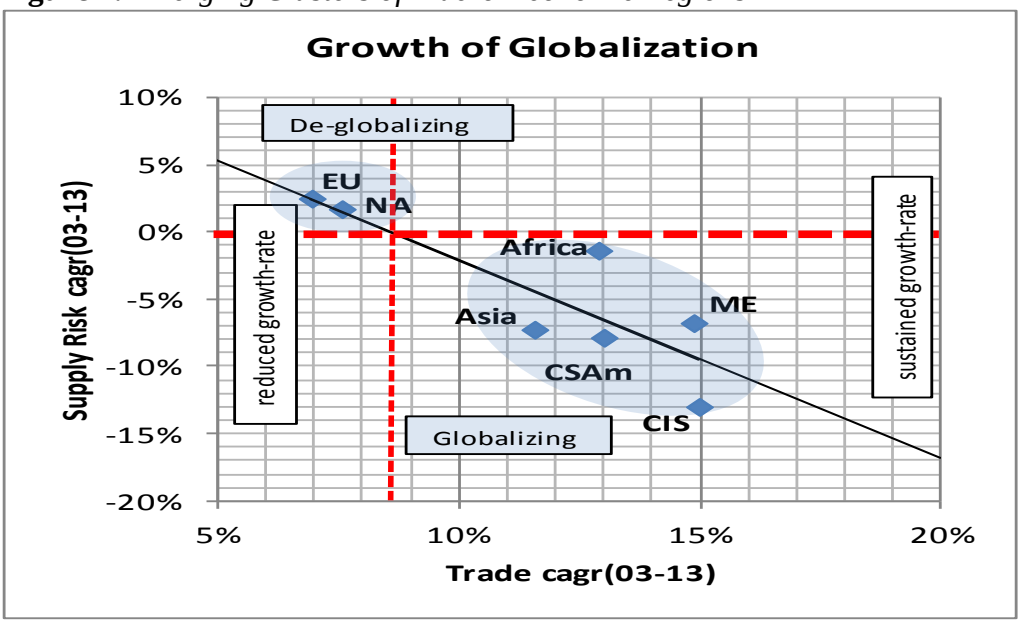
Figure 3. *Regional Pattern on Disaggregated Level*



Plotting the data from Table 2 regarding the different macro-economic geographical regions on a scatterplot, we obtain Figure 3 revealing the comparative evolution of globalization in the different geographic areas with increasing trade flows. The enveloping curve shows a similar pattern as the aggregated data in Figure 2, i.e. diminishing risk with growing trade volume. Nevertheless, whereas most regions are increasing global interweavement (diminishing their risk level) with growing trade volumes (such as SCA, CIS, ME, Asia), it is observable that Europe has steadily increased its risk level with growing trade volume from 0.21 in 2003 to 0.27 in 2013 and North America even more, from 0.71 to 0.90 in 2011 (leaving apart for the moment the value 0.85 of 2013), i.e. an antithetic evolution confirming postulate 3. We can therefore not generally state that increased trade volume is increasing global interweavement but as soon as economies are reaching a certain maturity (or let us say a temporal local maxima), there will install preferential trade destinations according to postulate 6. Have we to expect the same evolution on an aggregated level with further increasing trade flows, i.e. substituting the L-

shaped curve with a U-shaped curve with polynomial modeling to comply with Kuznets? As Figure 2 shows we have first indications to have reached the bottom-line of aggregated risk level (globalization) but it is by far too early to be confirmed.

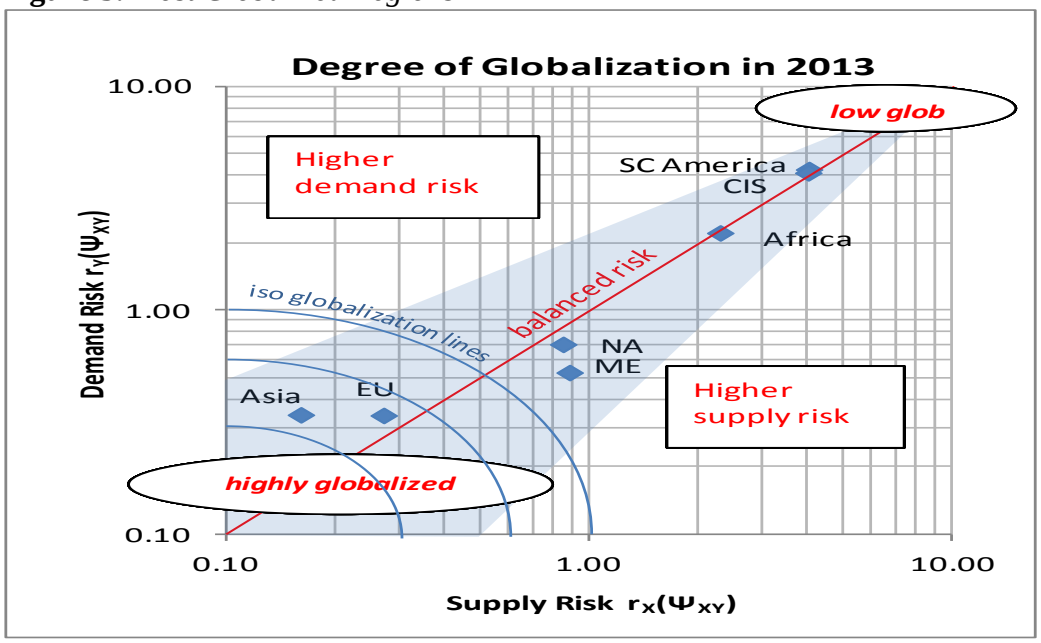
Figure 4. *Emerging Clusters of Macro-Economic Regions*



Analyzing the difference in globalization evolution in different geographical regions, comparing CAGR of trade and CAGR of supply risk according to Figure 4, we notice that there emerge two clusters: one with the advanced economies EU and NA and another with the emerging economies. The clusters of globalizing countries (SCA, CIS, ME, Africa, Asia) are characterized by high growth rates of trade whereas the de-globalizing countries (EU and NA) are characterized by reduced growth rates of trade; i.e. the segregation of pattern is not given by the absolute volume of trade but by the growth rate of trade, leading to postulate 4.

If we consider also the demand risk of an economical region, i.e. inequality in imports, we obtain the overall globalization evolution shown in Figure 5. From Figure 5 and Table 1 it emerges that EU lost its first position as the most globalized region from a sourcing view point with a demand risk rY(ψXY) of 0.34 and has to share it with Asia (2012 still with 0.36). This shows that Asia is not only exporting worldwide but also sourcing with increased interweavement. The overall most globalized region, according to Pareto iso-risk curves, is Asia, followed by EU and then ME and NA, i.e. reflecting mainly supply risk; we will continue therefore to concentrate on this dimension.

Figure 5. *Most Globalized Regions*



High risk level, i.e. high inequality, usually originates from predominant autarchic economy orientation with limited foreign trade. This is typical for emerging economies as well as for geographically isolated economies, such as SCA, or politically isolated economies, such as CIS, which focus on the home market. Low risk level, i.e. high globalization of trade, is seen in economies such as Asia, EU, ME, and NA with low trade barriers.

Figure 6. *Evolution of Regional Risk During Economic Cycle*

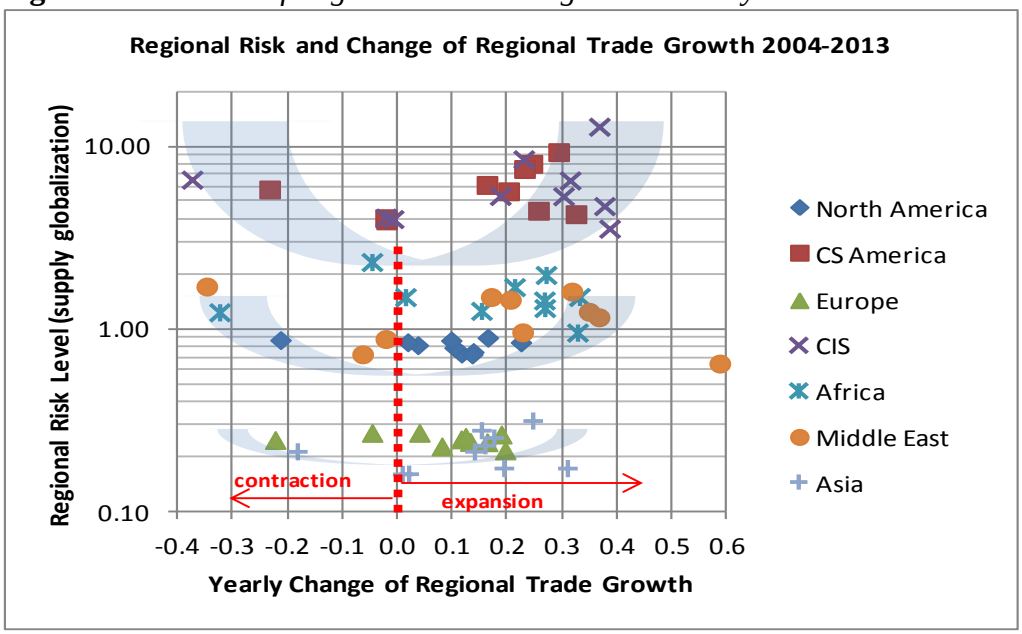


Figure 7. *Sensitivity of Regional Risk During Economic Cycle*

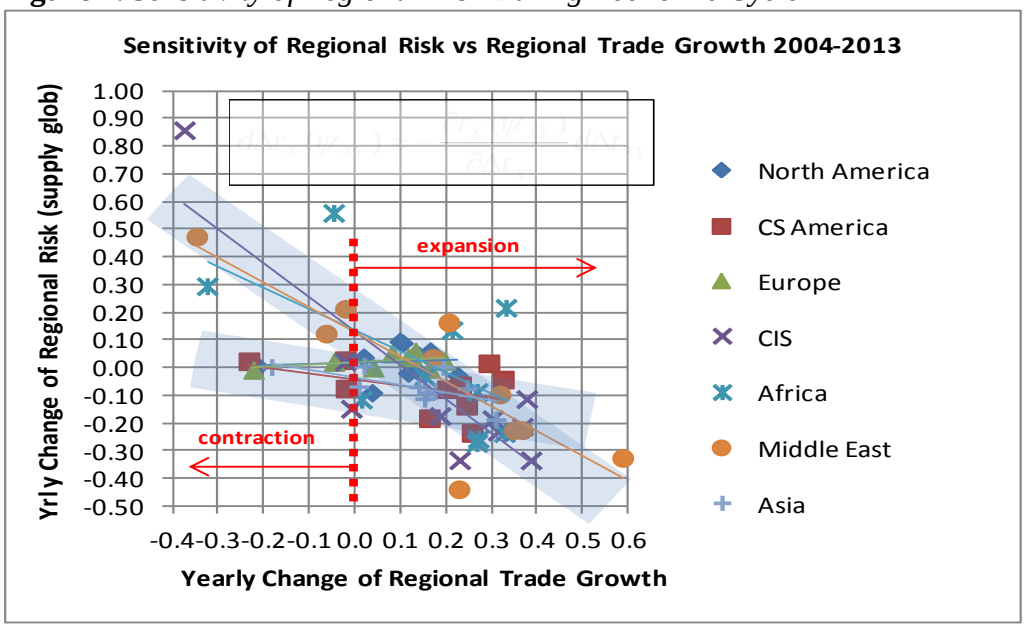


Figure 6 and Figure 7 show the behavior of globalization during the recession of an economic cycle. Figure 6 shows that risk level is increasing during a contraction of trade also on a disaggregated level as the model in Figure 2 shows. In addition, Figure 7 shows that there are different sensitivities in risk change of the different economic regions. Economic regions well endowed with commodities such as CIS, ME, and Africa show a coherent behavior of high sensitivity, whereas mature economies such as NA and EU show no relevant change in globalization levels during economic cycles; this reflects postulate 5. Only SCA behaved differently with low sensitivity; this shows that there are also other driving factors influencing risk change than merely change in economic cycle, such as a well balanced portfolio composition of destination countries for export giving more robust solutions.

Interpretation and Findings - Confirmation of Postulates for the Moment

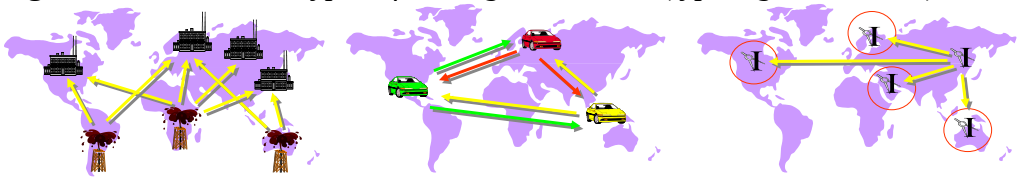
The question arises what are the causes of this different evolution in globalization leading finally to the Trade Globalization Postulates? From empirical interpretation there are possibly two main causes which drive the different evolutions of trade globalization (Rüttimann 2013):

- The maturity degree of economic region (advanced or emerging)
- The characteristics of product/goods (commodities or specialties, as well as low-cost products).

Indeed, the product characteristics determines the business type (commodities, standards, specialties, convenience) and the related globalization

types with its specific logic (Rüttimann 2007, 2009, 2011b). We will concentrate on the three subtypes of type 1 trade globalization: type 1a the globalization of commodities, type 1b the globalization of specialties, and type 1c the opportunistic low-cost globalization. Figure 8 shows synoptically the difference between the three subtypes of trade globalization. We have to be aware that globalization types may overlap, e.g. capital globalization type 2a with trade type 1b or type 1c; these globalization types, each with different logics, give a rough classification to facilitate understanding of globalization (Rüttimann 2007). Let us give in the following a brief overview; for detailed information we refer to (Rüttimann 2007, 2009, 2011b) entering into all three main types of economic globalization as well as their seven sub-types.

Figure 8. *The three subtypes of trade globalization (type 1 globalization)*



Type 1a is the globalization of commodities with unidirectional flows t_{od} from the country of origin O to the industry countries of destination D. The main drivers for this type of globalization are shown in Equation (2); these are the demand V_d for a certain commodity in the industrial country and the price p_r of the commodity which is determined by the demand/offer at efficient commodity exchanges, as well as the substitute materials and their prices p_s and the production cost P_o in the country of origin.

$$t_{od,r} = f\left(V_d(a_{i,}\frac{p_s}{p_r}), P_o(p_r), p_r(\frac{V_d}{P_o})\right) \qquad (2)$$

Type 1b is the globalization of specialties characterized by bidirectional trade flows t_{AB} between countries A and B modeled with Equation (3). The main drivers for that type of globalization are: the volume demand V_A and V_B for the product in the producing country A and the demanding countries B, as well as market growth rates g_A and g_B, their prices p_A and p_B for the products produced in A and B, as well as the comparative product characteristics $\pi_{\alpha\beta}$ and prices between similar products; for detailed explanation see (Rüttimann 2007, 2009, 2011b). Due to the differentiation possibilities of the products, the price fixing is made from the view of the value for the customer and competitive marketing decisions.

$$t_{AB} = f\left(V_{B,}\frac{1}{V_A}, g_B, \frac{1}{g_A}, \frac{p_{\alpha B}}{p_{\alpha A}}, \frac{p_{\beta B}}{p_{\alpha B}}, \pi_{\alpha\beta}\right) \qquad (3)$$

Type 1c is a transient globalization type with unidirectional trade flows t_{ZK} from the low-cost country Z to the high-price countries K and is based on exploiting the structural advantage of production cost Δp_{ZK}, as shown in Equation (4). The trade flows depend also on the capacity filling situation in the low-cost country (P_Z/V_Z) and how attractive the price differences (p_K/p_Z) are. This type of globalization is a transient type, existing as long as the opportunities are intact. Low-cost countries are e.g. the BRIC countries. Due to the different stages of maturity of the BRIC economies, this type will last for long (Rüttimann 2007, 2009, 2011b, 2010, 2011c).

$$t_{ZK} = t\left(V_K, \Delta p_{ZK}, s_{ZK}, \frac{p_K}{p_Z}, \frac{P_Z}{V_Z}\right) \qquad (4)$$

These Functional relations (2), (3), and (4) are based on empirical as well as theoretical considerations; they are derived from proven basic economic laws. The three different equations show that globalization is not equal to globalization; different driving logics govern the triggering and evolution of globalization leading to different trade globalization patterns. Giving insights to the transaction mechanism, they allow, together with the globalization types 2 and 3, to explain on macro-economic level the transaction evolution, in order to model competitive behavior and potential evolution of value chains (Rüttimann 208a, 2008b, 2010b). It has to be mentioned that the Equations (2), (3), and (4) are not state equations as generally used in neo-classic economy for modeling equilibrium, but they are functional relations modeling the triggering and transition from one state to the other, i.e. the dynamic aspect of evolution.

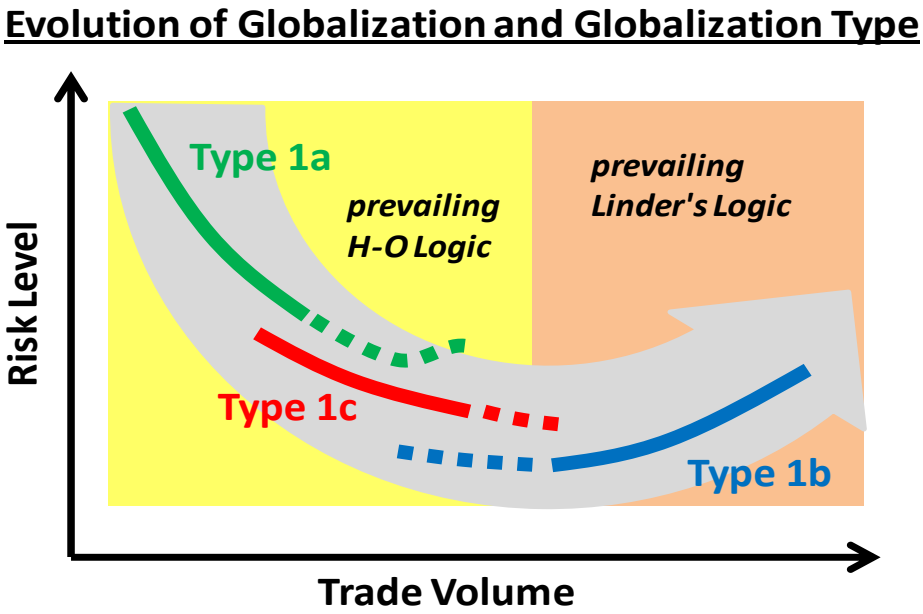
With that in mind, let us analyze the products of trade. In Table 3 of the annex (from Rüttimann 2013) are shown the export flows of main economic regions by product family divided in manufactured products, fuels and mining products, as well as agricultural products. The industry logic of manufactured products follows globalization type 1b and 1c, whereas the logic of fuels and mining trade flows are governed by globalization type 1a; basic agricultural commodities follow also type 1a globalization.

If we compare the information in Table 3 with the globalization evolution of different world regions in Figure 3, we can empirically draw the chart of Figure 9 (adapted from Rüttimann 2013), where we put the type of globalization on the evolution of globalization. This shows inverse Kuznets evolution, i.e. with decreasing inequality at the beginning and then, in mature advanced economic status, again with increasing inequality due to concentrated preferential trades. It shows that type 1a stands at the beginning of globalization evolution, followed by absolute cost-advantage and differentiated products in the evolution of an emerging economy. The rational of interpretation makes sense; indeed, emerging economies do not yet have developed technology to sell, but are often endowed with raw material to be extracted and shipped all over the world, increasing with that their globalization with sinking risk indicator according to type 1a globalization

logic (Heckscher-Ohlin's endowment pattern model). Preferential export destinations may increase risk indicator again, as is the case with African exports (Figure 1, period 2009-2013). Emerging economies can also benefit from low wages and have therefore an advantageous cost-structure to produce intermediates or low-technology products for export increasing globalization following the opportunistic low-cost type 1c globalization logic. Low-cost products are appealing for every economy and fuel therefore opportunistic type 1c globalization. Production of differentiated specialty products allow the development of further exports and are further fuelling globalization governed by the type 1b globalization logic.

After the initial 360° export orientation approach, mature economies will also install preferential destinations. This is given by the fact that similar (advanced) economies are more likely to have trade together than complementary economies (Linder's demand pattern model). Another deriving reason is, that trade partners are selected on economic return considerations and ethical business practices, which will invert the globalization tendency in terms of trade interweavement, concentrating commerce to selected destinations with bilateral trade agreements.

Figure 9. *Empiric Model of Globalization Evolution*



Nevertheless, the globalization type model explains the phenotypic dimension of trade, based on different business types such as commodities, specialties, standards, and convenience goods and their pertinent forms of globalization with its underlying rational (Rüttimann 2011a, 2012, 2013, 2011b, 2011c). It does not fully explain why we observe at the same time globalization (decrease of risk level) and de-globalization (increase of risk level) within the same economic area. Indeed, NA e.g. experienced in 2012 a

significant increase in globalization reducing its risk level from 0.90 in 2011 to 0.81 in 2012, against the trend observed since 2003 (Figure 1). On the other hand, EU reduced further its globalization level increasing its risk indicator from 0.26 in 2011 to 0.27 in 2012, continuing its steady de-globalization trend (N.B. risk value is still on a very low level documenting a very high trade interweavement with other regions, i.e. globalization, compared to other economic regions). This is partly due to the increase of trade for NA and the decrease in trade for EU (according to the aggregate modeling, Figure 2) but also for a more balanced export pattern for NA, finding new opportunities. The question arises, why certain countries or economic regions, i.e. the aggregation of economic actors, concentrate their trade on preferential destinations taking, deliberately or unintentionally, de-globalization, i.e. a higher risk, into account? Apart from Linder's demand pattern model and the inverse Kuznets type globalization evolution combined with the globalizations types model (Figure 9) there is a dualistic explanation.

Indeed, globalization can also be explained by the Minimum Risk Principle, derived from portfolio theory, and the CTG (Rüttimann 2011a, 2007). Apart from conjuncture-influenced structural change of the marginal distribution of the trade matrix, changing also inequality measures, economic policies are driven by maximizing profit. Maximizing profit means exploiting competitive advantages in areas where the products show a demand. This leads to abandon the Minimum Risk Principle exporting to all over the world and to concentrate flows, according to Linder's demand pattern model, to preferential destinations, following the Maximizing-Value-Net-of-Risk MVNR-Principle (Rüttimann 2011a, 2007), which can be assimilated to free enthalpy of a thermodynamic system. The paradigm to assimilate an economic system, composed of many economic actors, to a thermodynamic system, composed of many physics molecules, might be only approximate right; indeed molecules follow exact physics law whereas economic actors, even if they should behave like the "homo oeconomicus", they only can be considered in the average to be rational. Nevertheless, the average rational acting of economic actors leads to have trade with preferential economic partners in defind geographic regions, leading finally to de-globalization, measured as interweavement of trade flows, despite trade volume is increasing. This is why EU since 2003, and perhaps even before, shows a steady de-globalization trend.

Conclusions

Now, is globalization of economy coming to an end? Without doubt, signs are emerging that interweavement of trade, i.e. globalization, is slowing down. To say that globalization has coming to an end is for sure too early. The next couple of years will bring clarity about this phenomenon. Nevertheless, the globalization logic will be governed by the CTG and the MVNR principle.

Appendix

Table 1. *World Trade Matrix (in b$) with Inequalities and Risk Measures for the Year 2013*

Network of world merchandise trade by region (source: WTO International Trade Statistics, Table i04)

2013	North Am	SC Am	Europe	CIS	Africa	Middle E	Asia			
t_{XY}	A	B	C	D	E	F	G	Supply	p_X	Coverage
A	**1189.00**	**216.00**	**368.00**	**19.00**	**40.00**	**78.00**	**501.00**	2411.00	0.13	0.78
B	**178.00**	**195.00**	**121.00**	**9.00**	**20.00**	**18.00**	**178.00**	719.00	0.04	0.92
C	**506.00**	**129.00**	**4560.00**	**253.00**	**222.00**	**220.00**	**667.00**	6557.00	0.37	0.98
D	**33.00**	**9.00**	**407.00**	**149.00**	**13.00**	**19.00**	**139.00**	769.00	0.04	1.36
E	**54.00**	**30.00**	**216.00**	**2.00**	**97.00**	**18.00**	**160.00**	577.00	0.03	0.93
F	**110.00**	**11.00**	**143.00**	**6.00**	**38.00**	**135.00**	**703.00**	1146.00	0.06	1.51
G	**1012.00**	**191.00**	**855.00**	**128.00**	**188.00**	**270.00**	**3076.00**	5720.00	0.32	1.05
Demand	3082.00	781.00	6670.00	566.00	618.00	758.00	5424.00	**17899.00**	1.00	
p_Y	0.17	0.04	0.37	0.03	0.03	0.04	0.30	1.00	18301	reported

$p_{XY\infty}$	A	B	C	D	E	F	G	p_X
A	0.39	0.28	0.06	0.03	0.06	0.10	0.09	0.13
B	0.06	0.25	0.02	0.02	0.03	0.02	0.03	0.04
C	0.16	0.17	0.68	0.45	0.36	0.29	0.12	0.37
D	0.01	0.01	0.06	0.26	0.02	0.03	0.03	0.04
E	0.02	0.04	0.03	0.00	0.16	0.02	0.03	0.03
F	0.04	0.01	0.02	0.01	0.06	0.18	0.13	0.06
G	0.33	0.24	0.13	0.23	0.30	0.36	0.57	0.32
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Ψ_{XY}	A	B	C	D	E	F	G	$r_X(\Psi_{XY})$	r_X/r_Y
A	2.86	2.05	0.41	0.25	0.48	0.76	0.69	**0.85**	1.20
B	1.44	6.22	0.45	0.40	0.81	0.59	0.82	**4.04**	0.95
C	0.45	0.45	1.87	1.22	0.98	0.79	0.34	**0.27**	0.79
D	0.25	0.27	1.42	6.13	0.49	0.58	0.60	**4.02**	0.98
E	0.54	1.19	1.00	0.11	4.87	0.74	0.92	**2.30**	1.03
F	0.56	0.22	0.33	0.17	0.96	2.78	2.02	**0.88**	1.67
G	1.03	0.77	0.40	0.71	0.95	1.11	1.77	**0.16**	0.47
								1.79	
$r_Y(\Psi_{XY})$	**0.71**	**4.26**	**0.34**	**4.12**	**2.22**	**0.53**	**0.34**	***1.79***	***$r(\Psi_{XY})$***

Table 2. *Evolution of Supplies and Risks during 2003-2013 for Different Macro-economic Regions*

t_{xy}	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	cagr(03-13)
North America	**1163**	**1323**	**1477**	**1678**	**1852**	**2034**	**1600**	**1960**	**2282**	**2367**	**2411**	8%
CS America	**212**	**274**	**341**	**420**	**488**	**587**	**450**	**566**	**750**	**735**	**719**	13%
Europe	**3351**	**4008**	**4332**	**4906**	**5706**	**6367**	**4948**	**5561**	**6612**	**6306**	**6557**	7%
CIS	**191**	**261**	**321**	**423**	**503**	**699**	**439**	**572**	**789**	**784**	**769**	15%
Africa	**172**	**218**	**277**	**352**	**407**	**541**	**367**	**489**	**594**	**604**	**577**	13%
Middle East	**287**	**378**	**510**	**615**	**720**	**984**	**642**	**788**	**1251**	**1171**	**1146**	15%
Asia	**1916**	**2391**	**2761**	**3251**	**3775**	**4311**	**3532**	**4632**	**5538**	**5596**	**5720**	12%
World trade (b$)	**7290**	**8854**	**10020**	**11645**	**13451**	**15523**	**11978**	**14568**	**17816**	**17563**	**17899**	9%

Source: WTO

$r_X(\Psi_{XY})$	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	cagr(03-13)
North America	**0.71**	**0.75**	**0.73**	**0.72**	**0.79**	**0.86**	**0.87**	**0.84**	**0.90**	**0.81**	**0.85**	2%
CS America	**9.15**	**9.30**	**8.02**	**7.52**	**6.15**	**5.67**	**5.81**	**4.44**	**4.25**	**3.93**	**4.04**	-8%
Europe	**0.21**	**0.22**	**0.23**	**0.24**	**0.24**	**0.25**	**0.25**	**0.26**	**0.26**	**0.27**	**0.27**	2%
CIS	**16.16**	**12.66**	**8.39**	**6.43**	**5.29**	**3.50**	**6.49**	**5.27**	**4.65**	**3.95**	**4.02**	-13%
Africa	**2.64**	**1.95**	**1.42**	**1.29**	**1.24**	**0.94**	**1.22**	**1.48**	**1.68**	**1.48**	**2.30**	-1%
Middle East	**1.77**	**1.60**	**1.24**	**1.44**	**1.50**	**1.16**	**1.71**	**0.96**	**0.65**	**0.73**	**0.88**	-7%
Asia	**0.34**	**0.31**	**0.28**	**0.25**	**0.23**	**0.21**	**0.21**	**0.17**	**0.17**	**0.16**	**0.16**	-7%
World risk $r(\Psi_{XY})$	**4.43**	**3.83**	**2.90**	**2.56**	**2.20**	**1.80**	**2.37**	**1.92**	**1.79**	**1.62**	**1.79**	-9%

Source: Rüttimann

Table 3. *Regional Exports and Corresponding Main Globalization Types*

	Exports by region 2012 (billion US$), source: WTO (ii.2)			Main Type of
Economic Region	**Manufactures**	**Fuels & Mining**	**Agriculture**	**Globalization**
North America	1582	402	258	**1b**
South Central Am.	199	320	205	**1a**
Europe	4734	840	657	**1b**
CIS	187	530	66	**1a**
Africa	103	438	57	**1a**
Middle East	265	915	30	**1a**
Asia	4419	694	384	**1c, 1b**

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